COURSE DESCRIPTION

WIS 5496: Research Design in Wildlife Ecology and Conservation

ROOM 1037 NORMAN HALL -- 3-5 PM -- TUES & THURS

INSTRUCTOR:	DR. KATIE SIEVING -- 318 NEWINS-ZIEGLER HALL
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WEBSITE:	E-LEARNING IN CANVAS -- HTTPS://LSS.AT.UFL.EDU/

OVERVIEW AND COURSE GOALS

WIS 5496 is for graduate students studying ecological disciplines related to conservation in the developmental phase of their research. This course begins with logic and philosophy underlying scientific testing and proceeds to develop clear statements of research objectives, organization of rigorous research approaches and bulletproof sampling designs. You will develop the framework, specific objectives, methodologies and analytical data approach of your thesis/dissertation and incorporate them into a polished research proposal. The final document can be used for committee meetings, proposal defenses, and grant applications.

COURSE MODULES

MODULE I. ESSENTIAL SCIENCE PHILOSOPHY FOR ECOLOGISTS

What forms of truth does society expect of scientists? We will examine key historical themes defining current approaches in ecology. You will understand the fundamental importance of the **hypothetical deductive method** (HDM) and its adaptation in the effective use of both major **testing criteria** (falsification, confirmation). *Ecology relies 90% on **confirmation**, not **falsification**, but most ecologists don't know this because of a failure of philosophy to stand up and show them.* We will explore the common **modes** of scientific testing (verification, manipulation, comparison, correlation) and the various ***types of inference*** (causal, predictive, descriptive, and explanatory power) characteristic of new knowledge we create as scientists. We highlight the role of ***theory*** in guiding your work; how theories are constructed, tested, and how they evolve. Further, you will find and clarify a ***theoretical framework*** for your graduate research.

MODULE II. RESEARCH DESIGN: STUDY STRATEGY, LOGIC, ORGANIZATION

Research design defines the **strategy** of your research (Fig 1). You will construct your studies plank by plank. What are your overall, and specific, **research aims**? How exactly do you state your **objectives**, **hypotheses**, critical **tests**, and **predictions**? How do you identify key **assumptions** you are making and how do you identify and deal with alternative/**confounding factors**? What is the scale / content of your study **domain**? What **theoretical framework** will provide the best context for your research? What **constraints** do you face? What type of **inferential power** is required [causal, predictive, descriptive, or explanatory] to reach your research goal? Which **design type** will get the inference you need [descriptive, case-control, comparative, (quasi-) experimental, modeling, meta-analysis, etc.]? What, specifically, belongs in the beginning of your **research proposal** [Introduction, Background,], middle [Research Objectives & Design, Proposed Methods] and end [Synthesis & Significance] of your proposal?

MODULE III: SAMPLING DESIGN: TACTICS FOR ACHIEVING QUANTITATIVE RIGOR

Sampling design defines the **tactics** of your research (Fig. 1). Here we establish the principles / steps in creating a **rigorous sampling design** including **power analysis** (min. sample size estimation); choice of **methods** (including statistical analysis approaches); layout of your **variable structure** for each analysis (predictors, responses, their measures and predicted relationships); & **alignment** of your hypothesis tests with specific predicted outcomes expressed as statistical hypotheses.

Part of the fun is that we also examine adjacent aspects of life as a conservation scientist. As an ecologist, **statistical modeling** is key to your survival. You need to keep abreast of different analysis philosophies so you can adapt them to your needs. *[Bayesians, frequentists, information theorists, & machine learners are cooking up new analyses of interest each day!]*. **Ethics** come in various forms as well. For example, the ethical rationality of your research design is a consideration that **conservation scientists** must consider. Also, day to day **conflicts** in science (over data, personality, attribution) inevitably arise for all scientists, so we will examine **ethical theories** that can aid you in deciding how to act when confronted with conflict.

Figure 1. This class will give you confidence to conduct the correct study (best **STRATEGY**) and to conduct rigorous sampling (strongest **TACTICS**) so that your work will improve knowledge and practice. You want to always be in the **top right** quadrant. Otherwise, your science is not as good as it should be for conservation.

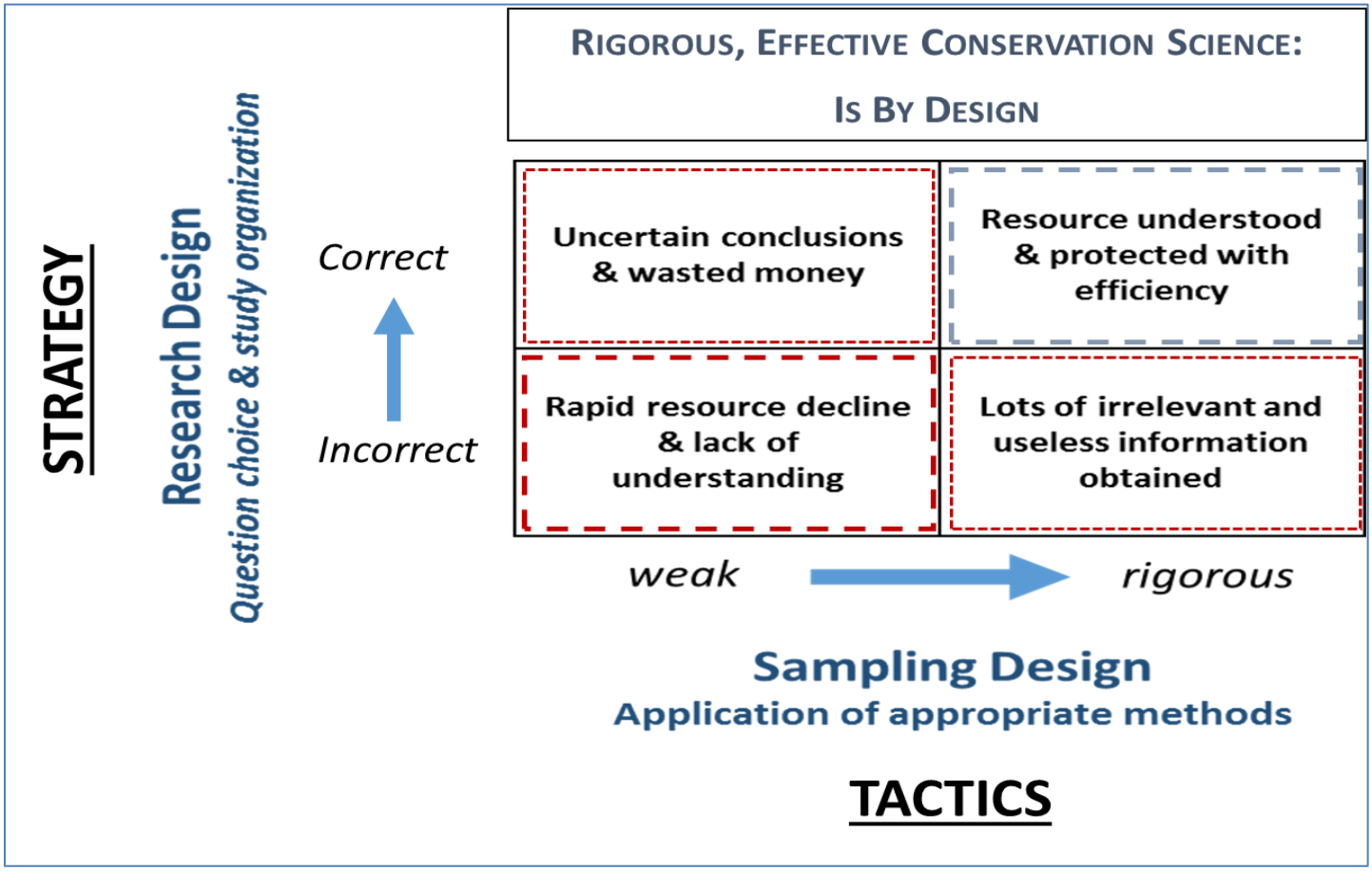

Figure 1. Doing the correct study poorly (top left) or the wrong study well (bottom right) are worse options than doing the wrong study poorly (bottom left). Why!? Because people may actually think you did ok.

Specific Learning Objectives: You will understand..

1. essential science philosophy/history; how "new" pluralism unites & invigorates natural science;
2. the structure, dynamics and utility for you of ecological theories, paradigms, and theory frameworks;
3. how hypothetical-deduction is a foundational logic of rigorous science;
4. how to apply different testing criteria, testing modes, and a full toolbox of research design groups;
5. best practices in sampling design, and how to deal effectively with sampling constraints;
6. how conservation objectives and ethics can influence study design, analysis, and interpretation of data;
7. how to organize and write an effective research proposal for different funding sources.

Grading:		
	Participation (attendance, preparation, in class presentation)	100
	Timely Homework exercises	200
	3 exams (125 pts each)	375
	Final Proposal	100
	Proposal Peer Review	100
	Total points	**875**

Exams: Will be a mix of online (essays, other) and in-class (short answers).
Required Texts: None need to be purchased – all readings will be linked via CANVAS.

Grading Philosophy: I will not be grading your research topic or choice of research approach in this class. I grade on effort (assignments/homework), participation, preparation, & improvement in research plan.

- Hard work in my class will directly benefit your research and your development as a scientist.
- Course grade will be determined on a percentage accumulation of total points (94% or more = A; 90-93% = A-; B+ = 87-89%; B = 84-86%; B- = 80-83%; C+ = 77-79%; C = 74-76%; etc.), unless application of a curve becomes necessary. UF grading policy: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

Participation Points & Absences: Complete your written homework and paper assignments on time! Late HW will lose points (5) each class they are late. Extended excused absences must be consistent with policies in the Catalog. See https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. **In my class** - just let me know when and why you can't be there, then it is YOUR responsibility to get with other students and catch up!

Prepare for discussions in class: I may assign students to lead discussions of assigned readings. Be prepared to lead (and contribute to) lively and thorough discussions that highlight understanding of the key concepts.

Keep a reading journal: It is the best way to prepare for discussions of readings! For each assigned reading, we will list the key concepts to know – write explanations of these concepts based on readings and then address any questions you have in class during discussions. Writing improves learning.

Be professional in your peer reviews of others' work: You will be required to critique (not edit) drafts of others' research proposals. Follow guidelines and give these reviews your best effort.

AI and chatbots: I will encourage you to utilize LLM's intelligently as useful tools in various aspects of scientific work, but large portions of exams will be done by **putting pencil to paper.** Make sure you understand and can write all your assignments yourself.

UF Resources, codes and policies for students: https://syllabus.ufl.edu/syllabus-policy/uf-syllabus-policy-links/

Bare Bones Course schedule – see CANVAS – Live Schedule for details				
MODULE I. *Essential Science Philosophy for Ecologists*				
FALL '25	TOPICS (readings/assignments posted on CANVAS)		Readings	Work Due (Th)
Week of	Tuesday	Thursday		
Aug 19/21	----	Course overview:		
Aug 26/28	1600-1930 Sci. Philosophy:	1930-1990 SciPhi:		HW1:
Sep 2/4	1990-2010 SciPhi:	2000-now SciPhi:		HW2:
Sep 9/11	Modern Theory:	Modern SciPhi:		HW3:
Sep 16/18	Review!	Midterm 1		

MODULE II. *Research Design: Strategy, Logic, Inferential Goal*				
FALL '25	TOPICS		Readings	Work Due (Th)
Date	Tuesday	Thursday		
Sep 23/25	Research Proposals:	Scientific Inference:		HW4:
Sept 30/Oct 2	Causal Designs 1:	Grad Guest Talks!		HW5:
Oct 7/9	Causal Designs 2:	Causal Designs 3:		
Oct 14/16	Predictive Designs:	Ecological designs:		HW6:
Oct 21/23	Design Practicum!	Midterm 2		

MODULE III. *Sampling Design: Tactics, Rigor, Feasibility*				
FALL '24	TOPICS (readings/assignments posted on CANVAS)		Readings	Work Due (Th)
Week of	Tuesday	Thursday		
Oct 28/30	Ethics 1:	Sampling Design 1:		HW7:
Nov 4/6	Sampling Design 2:	Sampling Design 3:		
Nov 11/13	Veterans Day – no class	Sampling Design 4:		HW8:
Nov 18/20	Sampling Design 5:	Data analysis scoping:		
Nov 25/27	Peer review – no class	Thanksgiving - no class		HW9:
Dec 2/4	Ethics 2: last class	READING DAY – No Class		MT 3 = online
NO FINAL EXAM but you will hand in Final Proposal (HW10) with completed graphical abstract - Finals Week				